

CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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COX [REDACTED] 25X1A

COUNTRY Czechoslovakia

DATE DISTR. 3 May 1951

SUBJECT Analysis of Czechoslovakian Artificial Manganese Dioxide

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25X1A

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SUPPLEMENT TO REPORT NO.

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DATE OF [REDACTED]

1. Because it is possible that the sample described above may have come from the same source as a previous sample acquired by the company making the chemical analysis, the chemical compositions of the 1950 sample and the earlier sample are reported here together.

Constituent	1950 Sample	1949 Sample
MnO ₂	71.72	74.83
Fe ₂ O ₃	0.40	0.36
Al ₂ O ₃	0.08	0.21
SiO ₂	0.25	0.30
CaO	None	Trace
MgO	None	None
SO ₃	None	0.024
BaO	None	None
Mn	46.31	48.78
Fe	0.28	
Cu	Nil	0.004
Pb	None	None
As	Nil	None
P	0.0065	Trace
Ni	None	None
Co	None	None

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3. Conclusions drawn from the reported analyses are as follows:*

- A. The material is a manganese dioxide of reasonable purity.
- B. The light and feathery consistency of the sample led to some doubt of its suitability for use in batteries.

On file in the CIA Library is a copy of [REDACTED] covering the analysis of a manganese dioxide sample obtained from the same source as the 1950 sample here described.

CLASSIFICATION

SECRET

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25X1A

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19 February 1951

S U B J E C T : "Special" Synthetic Manganese Dioxide (OCSigO),
(M. O. Job No. 450)

1. INTRODUCTION:

a. This report gives the results of a crystallographic and micro-structural characterization of a sample of manganese dioxide produced synthetically.

b. The sample, in the form of fine black powder, was submitted through the Office of the Chief Signal Officer, but no details as to source or process history were disclosed. (*B.D.S. sample P-51-16*)

c. Chemical composition of the sample was determined by emission spectroscopy. Surface area measurements were determined by low temperature nitrogen gas adsorption. The sample was examined in the electron microscope and by X-ray and electron diffraction techniques. Investigative techniques used are summarized in the attached appendix.

2. SUMMARY:

a. Spectrochemical analysis indicates that the sample is a manganese oxide of high purity, except for sodium and potassium. A list of minor and trace elements present is given in Table I below:

TABLE I

Minor and Trace Elements Present* in Sample MO-863

Si	- .24	Ti	-<.01
Al	- .20	K	- 2.00
Fe	- .16	Na	- .80
Mg	- .22	Mo	-<.01
Cu	- .0008	Sr	-<.002
Pb	- .05	B	-<.01
Sn	- .01	V	-<.01
Ca	- .20	Co	-<.01
Ni	-<.01	Ba	- .003
Cr	- .002		

NOTE* weight percentages correct to within a factor of two.

25X1A

2

[REDACTED] (Contd) 19 February 1951

b. The X-ray and electron diffraction patterns (prints of which are attached) are those of typical delta manganese dioxide.

c. Electron microscopy confirms the delta phase type morphology. Large, nearly equant anhedral particles characteristic of the delta phase type appear in all of the fields examined. El 1570C(attached) illustrates this.

d. The low surface area of the sample, 2 square meters/gram, is typical of delta phase type manganese dioxide.

e. Since no process history was disclosed, further interpretation of the results obtained cannot be given. It is believed that this material will not be suitable for use in military batteries.

25X1A [REDACTED]

- Appendix - 19 February 1951

The sample treatment and the methods employed in the various investigations are given below:

a. Electron Microscopy: A sample portion of the powdered material, approximately 1/2 grams, was placed on a clean glass plate, wetted with butyl acetate and slurried for three minutes. Parlodion, 2% in butyl acetate, was added and thoroughly mixed. A drop of this mixture was cast on the surface of clean distilled water. A portion of the resulting film was chosen, removed and mounted in the electron microscope. Representative fields were photographed at a magnification of 8,000 diameters and photographically enlarged four times, resulting in a final magnification of 32,000 diameters, at which scale 32 mm. represent one micron.

b. Electron Diffraction: An electron diffraction pattern was taken by transmission techniques with the sample mounted as prepared for electron microscopy (above). The print represents a four time photographic enlargement of ahe directly recorded pattern.

c. X-Ray Diffraction: X-ray diffraction powder patterns of portions of the samples were prepared using iron K alpha radiation in a Debye-type camera yielding a dispersion of one degree of two theta per millimeter of film.

d. Spectrochemical Analysis: The sample was burned to completion in a d.c. arc and the resultant spectra photographed. A specially selected spectrum line of each of the various constituent elements was measured for intensity and compared with the intensity of the manganese internal standard line. These data were used to determine the percentages of the elements present, using previously established working curves. The amounts of sodium and potassium were determined by a modified method, whereby lithium was the internal standard line instead of the manganese line.

e. Surface Area: The surface area of the sample was determined by low temperature nitrogen adsorption using the B.E.T. method. The sample was degassed at a temperature of 150°C and at a pressure of 10^{-5} mm of mercury for a period of _____ hours. Form the amounts of nitrogen adsorbed by the sample at the temperature of liquid nitrogen and at various pressure, the amount of nitrogen necessary to form a mono-molecular layer on the sample was calculated.

25X1A

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Next 2 Page(s) In Document Exempt

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